specification at least at page 17, lines 3-5 and from page 27, third line from the bottom to page 28, line 2. Claim 16 has been canceled. New claim 17 has been added and is supported by cancelled claim 16 and the portion of the specification noted above. Claim 17 also recites that the minimal quantity lubrication system is for "cutting or grinding," rather than "in which cutting or grinding is conducted." New claims 18 and 19, which recite the amount of ester in the composition, are also supported in the specification at least at page 17, lines 3-7. Finally, new claim 20 recites a method for cutting or grinding and incorporates subject matter similar to that in claim 17 and is supported by the specification as noted above. No new matter has been added by these amendments.

In Paper No. 6, the Examiner has rejected claims 1-16 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,171,903 of Koyama, *et al.* ("Koyama") or U.S. Patent No. 4,601,840 of Zehler, *et al.* ("Zehler") in combination with U.S. Patent No. 6,085,782 of Ott ("Ott"). Applicants respectfully traverse this rejection and the arguments in support thereof, and respectfully request reconsideration and withdrawal of the rejections.

Rejection Under § 103(a) Based on Koyama and Ott

The Examiner argues that Koyama teaches a lubricating oil composition for plastic working, metal working or for cutting and grinding which comprises: (i) a linear olefin having 6 to 40 carbon atoms as a base oil; (ii) at least one alcohol, glycol, polyalkylene glycol, or a derivative of polyethylene glycol or fatty acid, and (iii) at least one phenolic or amine compound. Component (ii) allegedly includes fatty acid esters of polyethylene glycol which may be added to the composition in an amount of 0.05 to 50 weight % of the entire composition. The Examiner contends that the ester component of Koyama meets the limitations of the claimed ester component. The composition of Koyama also allegedly includes alkyl-substituted phenols as component (iii) in an amount of 0.1 to 2.0 weight % based on the entire composition, which is

alleged to meet the limitation of the oiliness component of the claims according to (D) in claim 10. Finally, the Examiner argues that the composition of Koyama can also be blended with a suitable quantity of well known oiliness agents, extreme-pressure agents, rust inhibitors, corrosion inhibitors, and the like, and thus meets the claimed limitations of the cutting and grinding oil composition.

Additionally, the Examiner cites Ott for its teaching that "minimal quantity lubrication" is a term known in the lubricant art for tool working. Ott allegedly teaches that oil compositions can be supplied to workpieces in an amount of 20 ml per hour. The Examiner thus concludes that the cutting and grinding oil composition of Koyama can be applied to a workpiece in such a manner if so desired. Applicants respectfully traverse this rejection.

The present invention is directed to a cutting oil or grinding oil composition which may be advantageously utilized in a minimal lubrication system. In general, oil compositions for cutting or grinding have the tendency to gradually deteriorate during use, and finally become unusable. The used compositions must then be discarded as waste. Although the use of a minimal quantity lubrication system helps to reduce the waste, it does not solve the above problems. Consequently, it is desirable to utilize biodegradable oil compositions which are easily decomposable by microorganisms and which reduce the undesirable harmful influence on the environment. Additionally, desirable compositions are easy to supply to the portion of a metal to be worked and provide low stickiness and favorable lubricating properties. Applicants have found that oil compositions containing at least 20 mass % of an ester and having a kinematic viscosity of 1 to 100 mm^2/s at 40 °C achieve these objectives.

Koyama teaches a lubricating oil composition comprising a component (ii), which may contain fatty acid esters of polyethylene glycol, in an amount of 0.05 to 50 weight % of the entire composition. This teaching of Koyama regarding the fatty acid ester (column 16, lines 27-28) is the only description of the component which the Examiner alleges is the same as the ester

in the claimed invention. Koyama does not teach or suggest that the oil composition has a kinematic viscosity of 1 to 100 mm^2/s at 40 °C or that such would be desirable. The only mention of kinematic viscosity by Koyama relates to the base oil (column 3, lines 65-67), and there is no teaching or suggestion of any particular viscosity for the lubricating oil composition.

Koyama further does not teach or suggest the elements of dependent claims 2-5, which recite various properties of the ester component, including iodine value, bromine value, hydroxyl value, and saponification value. The only ester taught by Koyama is methyl laurate which is present in Comparative Example 11 in Table 11 and which does not read on claims 6 and 7. Specifically, methyl laurate does not comprise a polyhydric alcohol and a fatty acid having 2 to 24 carbon atoms. Finally, Koyama does not teach the addition of an oxidation inhibitor such as those described in claims 12-15. Rather, Koyama merely teaches in column 17, line 51 to column 18, line 2 that oiliness agents, extreme-pressure agents, rust inhibitors or defoaming agents may be added. For all of these reasons, Koyama does not teach or suggest all of the elements of the claimed cutting and grinding composition.

In comparison with the composition of Koyama, Ott teaches a device for transferring fluid from a stationary to a rotating machine part. Ott describes minimal quantity lubrication, which is explained to be useful for drills or milling tools. However, the lubricating oil composition of Koyama is designed to form an excellent surface for the material to be worked and further to improve the rust and wear resistance of the working tools (column 2, lines 7-10 and column 1, lines 21-25). There is nothing in Koyama to suggest using such a composition in a minimal quantity lubricating device, and the Examiner has not met her burden of showing that the motivation to make the proposed combination is found in the cited reference of Koyama. Further, when using a minimal quantity lubricating device as described by Ott, only a small quantity of oil is supplied as a mist to the working area. It would not be expected that such a small quantity of oil, supplied as a mist, would still provide the benefits of the oil composition of

Koyama.

Consequently, the proposed combination of Koyama and Ott is not valid. However, even if the combination were valid, it would not teach or suggest all of the claimed elements. Specifically, even the combination would not teach or suggest utilizing a minimal quantity lubrication system for cutting or grinding, the appropriate percentage of ester to use in such an application or the desired kinematic viscosity, and thus would not teach or suggest the elements of the claims. Therefore, no *prima facie* case of obviousness has been established by the Examiner.

Rejection Under § 103(a) Based on Zehler and Ott

The Examiner argues that Zehler teaches an improved mist lubrication process which utilizes a composition comprised of synthetic esters and a mixture of isobutylene polymers having different molecular weights. The synthetic esters include polyol esters, trimetallitate esters and polymeric fatty acid esters; the polyol esters are derived from an aliphatic polyol having from 2 to 8 hydroxyl groups and 3 to 12 carbon atoms and an aliphatic monocarboxylic acid having from 5 to 20 carbon atoms. Zehler allegedly teaches that mist lubrication processes are well known and that numerous mist lubrication systems, as well as operating conditions, have been described in the art. Specifically, mist generators consisting of a lubricant and a compressed gas such as air are used to form oil mists. The Examiner further argues that the composition may also include conventional mist oil additives such as antioxidants, antiwear/extreme pressure agents, rust and corrosion inhibitors, and the like, and concludes that the mist oil composition of Zehler meets the claimed limitations of the cutting and grinding oil compositions.

Additionally, the Examiner combines Zehler with Ott for its alleged teaching that such oils may be used in "minimal quantity lubrication." The Examiner contends that Ott teaches

supplying a constantly uniform oil mist in a steady and even manner to the working area of a tool to be worked. Thus, the Examiner concludes that the mist of composition of Zehler can be applied to workpieces in such a "minimal quantity lubrication" process if so desired. Applicants respectfully traverse this rejection.

Zehler teaches an improved mist lubrication process. The Examiner argues that Zehler teaches an oil composition comprising synthetic esters such as polyol esters, polymeric fatty acid esters, etc, and further teaches the presence of numerous mist lubrication systems. However, the oil mist lubricants are particularly designed for lubricating the roll bearings in hot strip mills in steel processing operations (column 1, lines 23-24). In column 3, lines 18-20, Zehler teaches that the lubricants have 40 °C viscosities of 125 to 750 centistokes (mm^2/s). Therefore, Zehler teaches away from the claimed 1 to 100 mm^2/s kinematic viscosity recited in the independent claims for the preferred cutting and grinding application of the claimed composition and method. Furthermore, because the intended use of the lubricants of Zehler for lubricating hot strip mills requires high viscosities, it would not be obvious based on Zehler to utilize the significantly lower claimed viscosities.

Additionally, Zehler does not teach or suggest cutting or grinding, and thus even the proposed combination with Ott would not teach or suggest all of the claimed elements. Therefore, no *prima facie* case of obviousness has been established by the Examiner.

Even if a *prima facie* case had been established based on Ott and either Koyama or Zehler, Applicants' invention demonstrates unexpected results which would overcome such a case. Specifically, the compositions according to the present invention have desirable properties which are exemplified in the inventive examples. For example, as seen in Example 1 (especially Table 1 at page 30), an oil composition having a kinematic viscosity at 40 °C of 19.1 mm^2/s exhibited excellent lubricating properties, made the finished surface smooth, and prevented the wearing of tools. Additionally, the environmental hazard of such a composition was low.

Further, the composition of Example 2, as shown in Table 2 at page 34, displayed low stickiness. These favorable results would not be expected based on the cited prior art references and thus would overcome any case of *prima facie* obviousness. Accordingly, reconsideration and withdrawal of the § 103(a) rejections are respectfully requested.

In view of the foregoing amendment and remarks, applicants respectfully submit that the pending claims are in condition for allowance and patentable over the cited prior art. A Notice of Allowance is respectfully requested.

Respectfully submitted,

HIDEO YOKOTA *ET AL*

9/19/02
(Date)

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Mark-Up Version f Claim 1

--1. (Amended) A cutting or grinding oil composition for a minimal quantity lubrication system comprising at least 20 percent by mass of an ester based on a total amount of the composition, wherein the composition has a kinematic viscosity of 1 to 100 mm^2/s at 40 °C.